COURSE SYLLABUS

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YEAR COURSE OFFERED: 2023
SEMESTER COURSE OFFERED: Fall
DEPARTMENT: Computer Science
COURSE NUMBER: COSC3380
NAME OF COURSE: Database Systems
NAME OF INSTRUCTOR: Carlos Ordonez
TEACHING MODE: Face to face

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The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.
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Learning Objectives

Students will gain a basic understanding on the theory and internal systems aspects to design, update and query a relational database, managed by a DBMS. From a theory perspective, there will be an introduction to first order logic, set theory, relational algebra, functional dependencies and normalization. From a programming perspective, students will learn how to design a database with ER, create tables, indexes, schemas, as well as developing queries and transactions in SQL. The course will give an overview of the main subsystems of a DBMS, including the file system, storage manager, locking manager, transaction scheduler, query optimizer and recovery manager.

Major Assignments and Exams

Grading is as follows:

- 40%: 2 programming assignments, to be developed in teams of 4 students. HW1 20% (learning goal: queries+normalization), HW2 20% (learning goal: transactions processing, complex queries, web app). HW1: getting familiarized with Unix/DBMS, programming environment SQL queries, functional dependencies & normalization; HW2: designing an ER database model, developing SQL transactions, defining SQL queries, and creating a web application program with JavaScript+HTML (preferred) or Python (acceptable, but no TA support), sending SQL statements to the DBMS, retrieving query results and displaying them on the web page. Both homeworks will be developed in 2 phases. For both homeworks, Phase 1 will be PASS/FAIL and it is a requirement to submit Phase 2: Phase 2 will not be accepted without Phase 1 submitted and passed. A score will be assigned based on 10 test cases of varying difficulty and checking source code originality and quality. For HW2 Phase 2 there will be a short window for resubmission of minor fixes (with 0% penalty if resubmitted within 3 hours, otherwise, 10%-20% penalty depending on the number and importance of source code fixes, logistics TBA).

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- 60%: 3 exams. Each exam has weight 20%. The exams will be individual, in-class, closed-everything (no notes, no Internet/computer access). Each exam has 10 questions, short answer.
- Bonus points: Up to 5 points out of 100 (i.e. up to 5%), towards final grade, based on participation (in-class, answering theory and database system programming questions).

Required Reading

ELMASRI, R. AND NAVATHE, S. B. 2006. Fundamentals of Database Systems, 5th edition (any later edition is acceptable, all fundamental chapters are the same). Addison/ Wesley, Redwood City, California.

List of lecture topics

1. Math review: set theory, boolean algebra, first order logic
2. Relational algebra, extended algebra and SQL
3. Relational model: domains, tuples, arity, cardinality
4. Functional dependencies: simple/composite keys, axioms, closures
5. Normalization: lossless decomposition, up to 3NF and BCNF, distinguishing both forms
6. Database design and software engineering: ER model, flows, enterprise architectures
7. System architecture of a DBMS: subsystems, interaction with OS: Storage, Indexing, transaction/locking manager, query optimizer
8. Transaction processing: ACID, locking, timestamping, MVCC
9. Query processing: SPJA queries, derived tables/view, optimization, cost optimization
10. Advanced (if there is time and interest): MVDs, 5NF, UDFs, pivoting, recursive queries, security, embedded database systems, machine learning.

Logistics

1. Office hours: students are encouraged to meet instructor after class, after every lecture
2. On-line lectures: about 25% of lectures will be on-line, covering programming, more theory and reviews for exams
3. Messaging: we will setup a discord group, which will be monitored by TAs. MS Teams will be used mostly during online lectures.
4. E-mail: preferred communication for personal issues (medical, family, exceptional circumstances)

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Reasonable Academic Adjustments/Auxiliary Aids

The University of Houston complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for disabled students. In accordance with Section 504 and ADA guidelines, UH strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact the Justin Dart Jr. Student Accessibility Center (formerly the Justin Dart, Jr. Center for Students with Disabilities).

Excused Absence Policy

Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class

Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Justin Dart, Jr. Student Accessibility Center. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and notetaking. Instructor's recordings are not authorized to be shared with anyone without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.